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HIGH-MU TWIN TRIODE

9-PIN MINIATURE TYPE

Intended for applications where dependable performance under shock and vibration is paramount, and for "on-off" control applications involving long periods of operation under cutoff conditions. The 6201, a "premium" version of the 12AT7, may be used at frequencies up to 300 Mc.

GENERAL DATA

Electrical:

Heater, Pure Tungsten, for Unipotential Cathodes:

Heater arrangement	*Series*	*Parallel*	
Voltage	12.6 ± 10%	6.3 ± 10%	ac or dc volts
Current	0.15	0.3	amp

Direct Interelectrode Capacitances (Approx.):

Grid-Drive Operation:	*Without External Shield*	*With External Shield**	
Grid to plate (Each unit)	1.6	1.6	μμf
Grid to cathode and heater (Each unit)	2.5	2.5	μμf
Plate to cathode and heater (Unit No.1)	0.45	1.2	μμf
Plate to cathode and heater (Unit No.2)	0.38	1.3	μμf
Heater to cathode (Each unit)	2.8	2.8	μμf
Plate to plate	0.24	-	μμf

Cathode-Drive Operation:	*Without External Shield*	*With External Shield*●	
Plate to cathode (Unit No.1)	0.2	0.18	μμf
Plate to cathode (Unit No.2)	0.24	0.2	μμf
Cathode to grid and heater (Each unit)	5	5	μμf
Plate to grid and heater (Unit No.1)	1.9	2.7	μμf
Plate to grid and heater (Unit No.2)	1.8	2.7	μμf

Characteristics, Class A_1 Amplifier (Each Unit):

Plate-Supply Voltage	100	250	volts
Cathode Resistor	270	200	ohms
Amplification Factor	57	60	
Plate Resistance (Approx.)	14300	10900	ohms
Transconductance	4000	5500	μmhos
Plate Current	3.3	10	ma
Grid Voltage (Approx.) for plate current of 10 μamp	-5	-12	volts

*,●: See next page.

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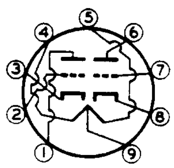
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Mechanical:

Mounting Position . . . . Any
Maximum Overall Length. . . . . 2-3/16"
Maximum Seated Length . . . . 1-15/16"
Length, Base Seat to Bulb Top (Excluding tip) 1-9/16" ± 3/32"
Maximum Diameter. . . . . 7/8"
Dimensional Outline . . . . *See General Section*
Bulb. T-6-1/2
Base. . . . . .Small-Button Noval 9-Pin (JETEC No.E9-1)
Basing Designation for BOTTOM VIEW. 9A

Pin 1 – Plate of Unit No.2
Pin 2 – Grid of Unit No.2
Pin 3 – Cathode of Unit No.2
Pins 4 & 9 – Heater of Unit No.2
Pins 5 & 9 – Heater of Unit No.1



Pin 6 – Plate of Unit No.1
Pin 7 – Grid of Unit No.1
Pin 8 – Cathode of Unit No.1
Pin 9 – Heater Mid-Tap

AMPLIFIER – Class A_1

Values are for Each Unit

Maximum Ratings, ***Absolute Values:***

PLATE VOLTAGE	330 max.	volts
GRID VOLTAGE:		
Negative bias value	55 max.	volts
Positive bias value	0 max.	volts
PLATE DISSIPATION	2.75 max.	watts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode .	100 max.	volts
Heater positive with respect to cathode .	100 max.	volts
BULB TEMPERATURE (At hottest point on bulb surface).	180 max.	°C

Maximum Circuit Values:

Grid-Circuit Resistance:		
For fixed-bias operation.	0.25 max.	megohm
For cathode-bias operation.	1.0 max.	megohm

Typical Operation as Resistance-Coupled Amplifier:

See RESISTANCE-COUPLED AMPLIFIER CHART at end of tabulated data for this type

* With external shield JETEC No.315 connected to cathode of unit under test.

● With external shield JETEC No.315 connected to grid of unit under test.

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CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN●

Values Are For Each Unit and are Initial, Unless Otherwise Specified

	Note	Min.	Max.	
Heater Current	1	0.138	0.162	amp
Direct Interelectrode Capacitances:				
Grid to plate	2	1.3	1.9	μμf
Grid to cathode and heater	2	2	3	μμf
Plate to cathode and heater (Unit No.1)	2	0.2	0.7	μμf
Plate to cathode and heater (Unit No.2)	2	0.16	0.6	μμf
Heater to cathode	2	2.1	3.5	μμf
Plate to plate	3	0.15	0.33	μμf
Amplification Factor	1,4	50	70	
Plate Current (1)	1,4	7	14	ma
Plate-Current Difference Between Units	1,4	–	3.2	ma
Plate Current (2)	1,5	–	100	μamp
Transconductance (1)	1,4	4500	6500	μmhos
Transconductance (1) at 500 Hours	1,4	3800	6500	μmhos
Transconductance (2)	3,6	4100	–	μmhos
Transconductance Change: Difference between average transconductance (1) initially, and average after 500 hours, expressed as a percentage of the initial average	1,4	–	15	%
Reverse Grid Current	1,7	–	0.7	μamp
Grid Emission Current	8,9	–	1.5	μamp
Heater-Cathode Leakage Current:				
Heater negative with respect to cathode	1,10	–	10	μamp
Heater positive with respect to cathode	1,10	–	10	μamp
Leakage Resistance:				
Between grid and all other electrodes tied together	1,11	100	–	megohms

● Each tube is stabilized before characteristics testing by continous operation for at least 45 hours at room temperature and with dissipation values equivalent to life test conditions.

Notes 1 to 11: See next page.

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	Note	Min.	Max.	
Leakage Resistance:				
Between plate and all other electrodes tied together.	1,12	100	-	megohms
Leakage Resistance at 500 Hours:				
Between grid and all other electrodes tied together.	1,11	50	-	megohms
Between plate and all other electrodes tied together.	1,12	50	-	megohms

Note 1: With 12.6 volts ac or dc on heater (series connection).

Note 2: Without external shield and with unit not under test connected to ground.

Note 3: Without external shield.

Note 4: With dc plate-supply volts = 250, cathode resistor (ohms) = 200, and cathode bypass capacitor of 1000 μf. Each unit tested separately. Unit not under test connected to ground.

Note 5: With dc plate-supply volts = 250, plate load resistance (megohms) = 0.1, and dc grid volts = −20. Each unit tested separately. Unit not under test connected to ground.

Note 6: With 11.0 volts ac or dc on heater (series connection).

Note 7: With dc plate-supply volts = 250, grid-circuit resistance (megohms) = 0.5, cathode resistor (ohms) = 200, and cathode bypass capacitor of 1000 μf. Each unit tested separately. Unit not under test connected to ground.

Note 8: With 15.0 volts ac or dc on heater (series connection).

Note 9: With dc plate volts = 250, grid-circuit resistance (megohms) = 0.5, and dc grid volts = −20. Each unit tested separately.

Note 10: With 100 volts dc between heater and cathode and units connected in parallel.

Note 11: With grid 100 volts negative with respect to all other electrodes tied together.

Note 12: With plate 300 volts negative with respect to all other electrodes tied together.

SPECIAL RATINGS & PERFORMANCE DATA

Shock Rating:

Impact Acceleration. . . . . 600 max. g

This test is performed on a sample lot of tubes from each production run in a Navy Type, High-Impact (flyweight) Shock Machine. Tubes are held rigid in four different positions and are subjected to 20 blows at the specified maximum impact acceleration. At the end of this test, tubes will not show permanent or temporary shorts or open circuits, and are required to meet established limits for vibrational acceleration, heater-cathode leakage current, and transconductance.

Fatigue Rating:

Vibrational Acceleration . . . . 2.5 max. g

This test is performed on a sample lot of tubes from each

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production run. Tubes are rigidly mounted and subjected in each of three positions to 2.5 g vibrational acceleration at 25 cycles per second for 32 hours. At the end of this test, tubes will not show permanent or temporary shorts or open circuits, and are required to meet established limits for impact acceleration, heater-cathode leakage current, and transconductance.

Low-Frequency Vibration Performance:

RMS Output Voltage. . . . . 100 max. mv

This test is performed on a sample lot of tubes from each production run under the following conditions: plate of unit No.1 tied to plate of unit No.2, grid of unit No. 1 tied to grid of unit No.2, heater volts = 12.6, dc plate volts = 250, dc grid volts = -3, plate load resistance (ohms) = 2000, and vibrational acceleration of 2.5 g at 25 cycles per second.

Heater-Cycling Life Performance:

Cycles of Intermittent Operation. . . . . 2000 min. cycles

Under the following conditions and with the heaters of unit No.1 and unit No.2 connected in parallel: heater volts = 7.5 cycled one minute on and one minute off, heater 135 volts positive with respect to cathode, and plate and grid volts = 0.

Audio-Frequency Noise and Microphonic Performance:

RMS Output Voltage. . . . . 100 max. mv

This test is performed on a sample lot of tubes from each production run under the following conditions: plate of unit No.1 tied to plate of unit No.2, grid of unit No.1 tied to grid of unit No.2, dc heater volts = 12.6, plate-supply volts = 300, cathode resistor (ohms) = 200 common to both units, and plate load resistance (ohms) = 10,000.

Shorts and Continuity Test:

This test is performed on a sample lot of tubes from each production run. In this test, a tube is considered inoperative if it shows a permanent or temporary short or open circuit, or a value of reverse grid current in excess of 1.4 microamperes under the conditions specified in the CHARACTERISTICS RANGE VALUES for reverse grid current.

1-Hour Stability Life Performance:

This test is performed on a sample lot of tubes from each production run to insure that the tubes have been properly stabilized. With both units operating, each unit is checked for variation in transconductance under conditions of maximum rated plate dissipation. At the end of 1 hour, the value of transconductance is read. The variation in transconductance from the 0-hour reading will not exceed 10 per cent.

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100-Hour Life Performance:

This test is performed on a sample lot of tubes from each production run under the conditions of maximum rated plate dissipation to insure a low percentage of early inoperatives. At the end of 100 hours, a tube is considered inoperative if it shows a permanent or temporary short or open circuit, or a value of reverse grid current in excess of 1.4 microamperes under the conditions specified in CHARACTERISTICS RANGE VALUES for reverse grid current.

500-Hour Average Life Performance:

This 500-hour test is made on a sample lot of tubes from each production run to insure high quality of the individual tube and to guard against epidemic failures of any of the characteristics indicated below. With both units operating, each unit is life tested separately at room temperature under the following conditions: heater volts = 12.6 ac or dc (series connection), plate-supply volts = 250, cathode resistor (ohms) = 200, grid-circuit resistance (megohms) = 0.5, heater 135 volts positive with respect to cathode, and bulb temperature (°C) = 180. At the end of 500 hours, tube will not show permanent shorts or open circuits and will be criticized for the total number of defects in the sample lot and for the number of tubes failing to pass the established initial limits for heater current, reverse grid current, heater-cathode leakage current, and 500-hour limits for transconductance (1), transconductance change, and leakage resistance as shown under CHARACTERISTICS RANGE VALUES.

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OPERATING CONSIDERATIONS AS RESISTANCE-COUPLED AMPLIFIER (Each Unit)

Plate-Supply Voltage	90			volts
Plate Load Resistor	0.1	0.24	0.51	megohm
Grid Resistor (Of following stage)	0.24	0.51	1	megohm
Cathode Resistor	2400	5300	11000	ohms
Peak Output Voltage	13	15	16	volts
Voltage Gain▲	27	28	28	
Plate-Supply Voltage	180			volts
Plate Load Resistor	0.1	0.24	0.51	megohm
Grid Resistor (Of following stage)	0.24	0.51	1	megohm
Cathode Resistor	1400	3600	7100	ohms
Peak Output Voltage	28	31	33	volts
Voltage Gain▲	33	33	32	
Plate-Supply Voltage	300			volts
Plate Load Resistor	0.1	0.24	0.51	megohm
Grid Resistor (Of following stage)	0.24	0.51	1	megohm
Cathode Resistor	1200	2900	6400	ohms
Peak Output Voltage	47	52	55	volts
Voltage Gain▲	33	34	34	

▲ At 2 volts (rms) output.

Note: Coupling capacitors should be selected to give desired frequency response. Cathode resistors should be adequately bypassed.

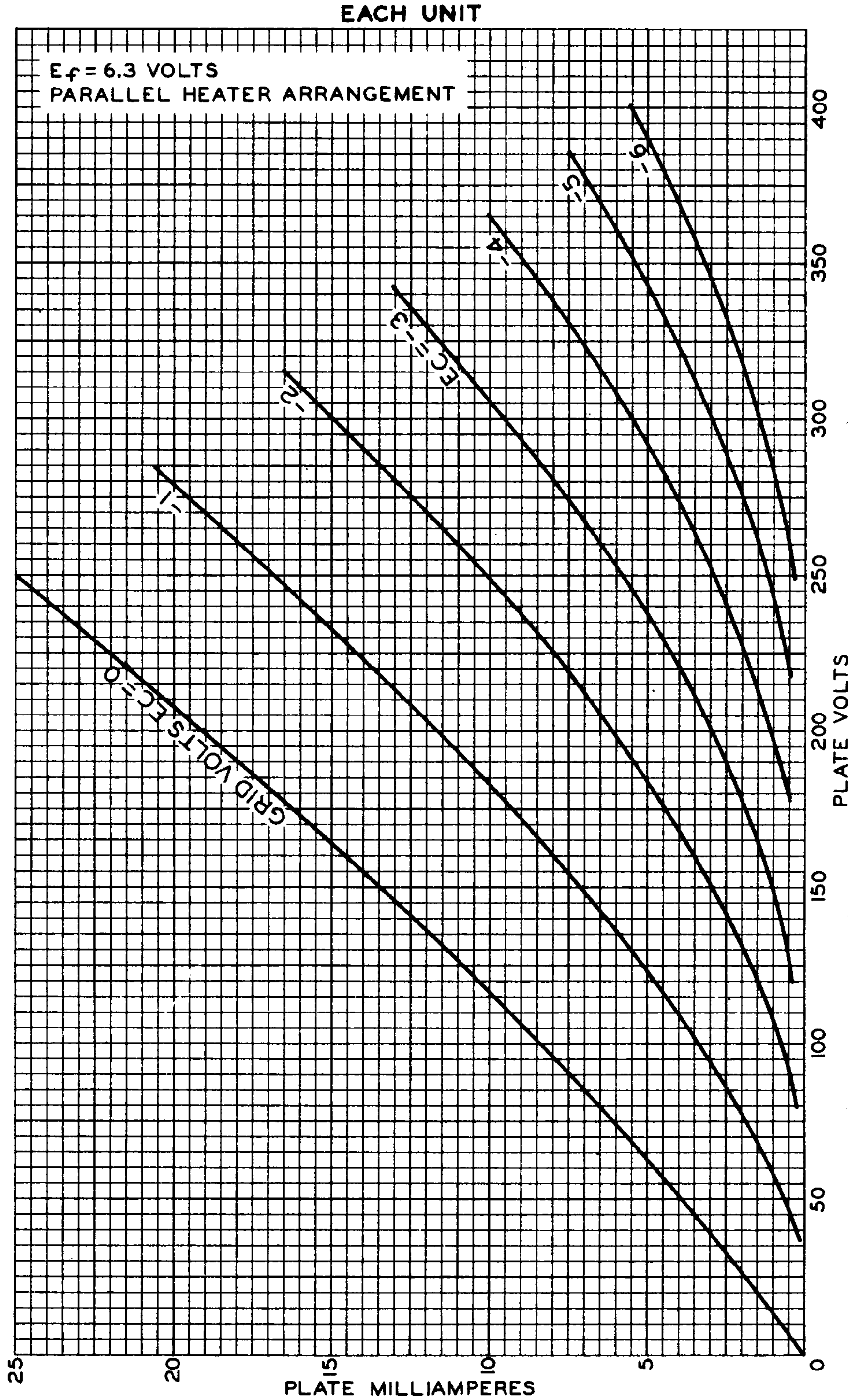
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AVERAGE PLATE CHARACTERISTICS

EACH UNIT



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AVERAGE CHARACTERISTICS
EACH UNIT

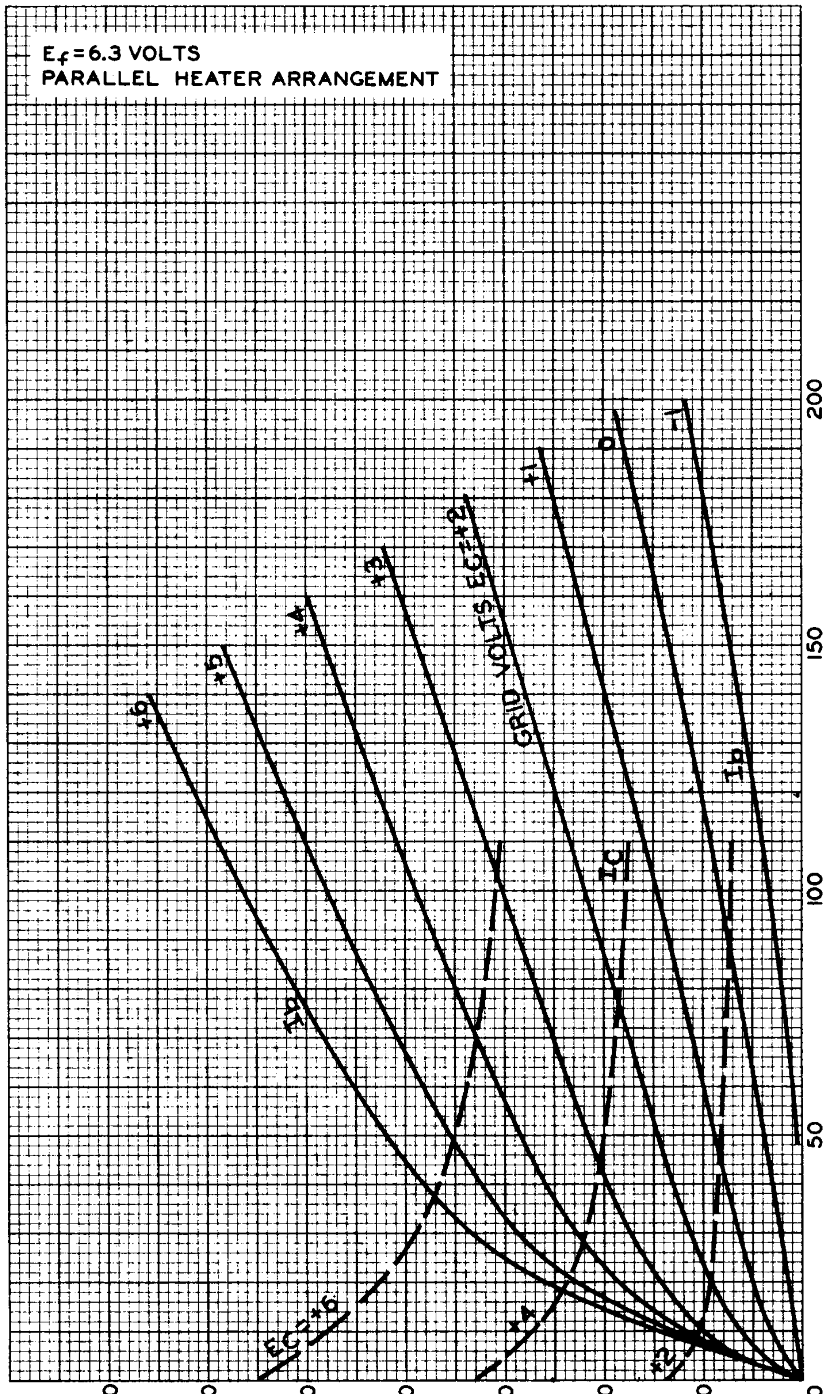


PLATE (I_b) OR GRID (I_c) MILLIAMPERES

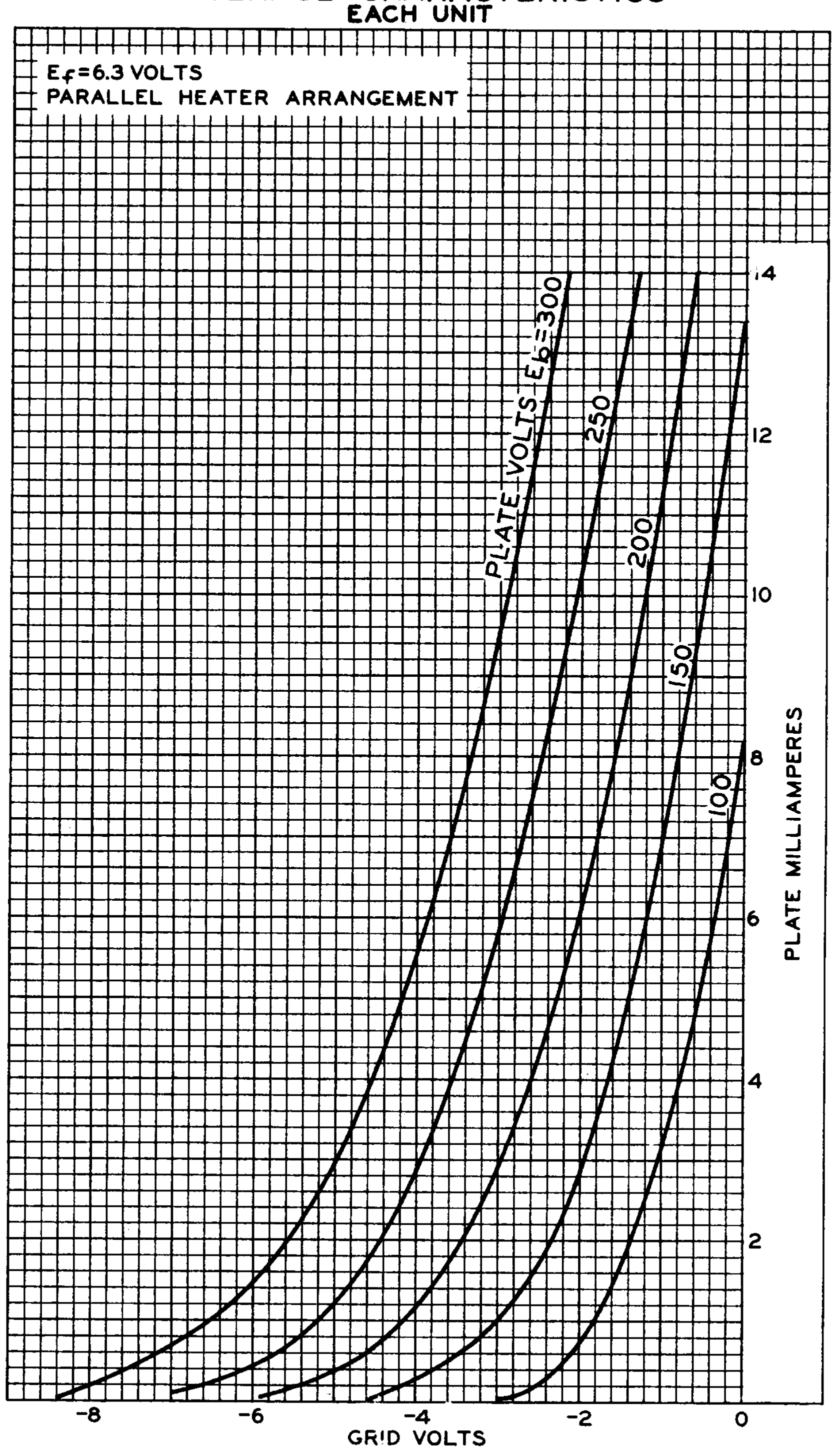
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AVERAGE CHARACTERISTICS
EACH UNIT

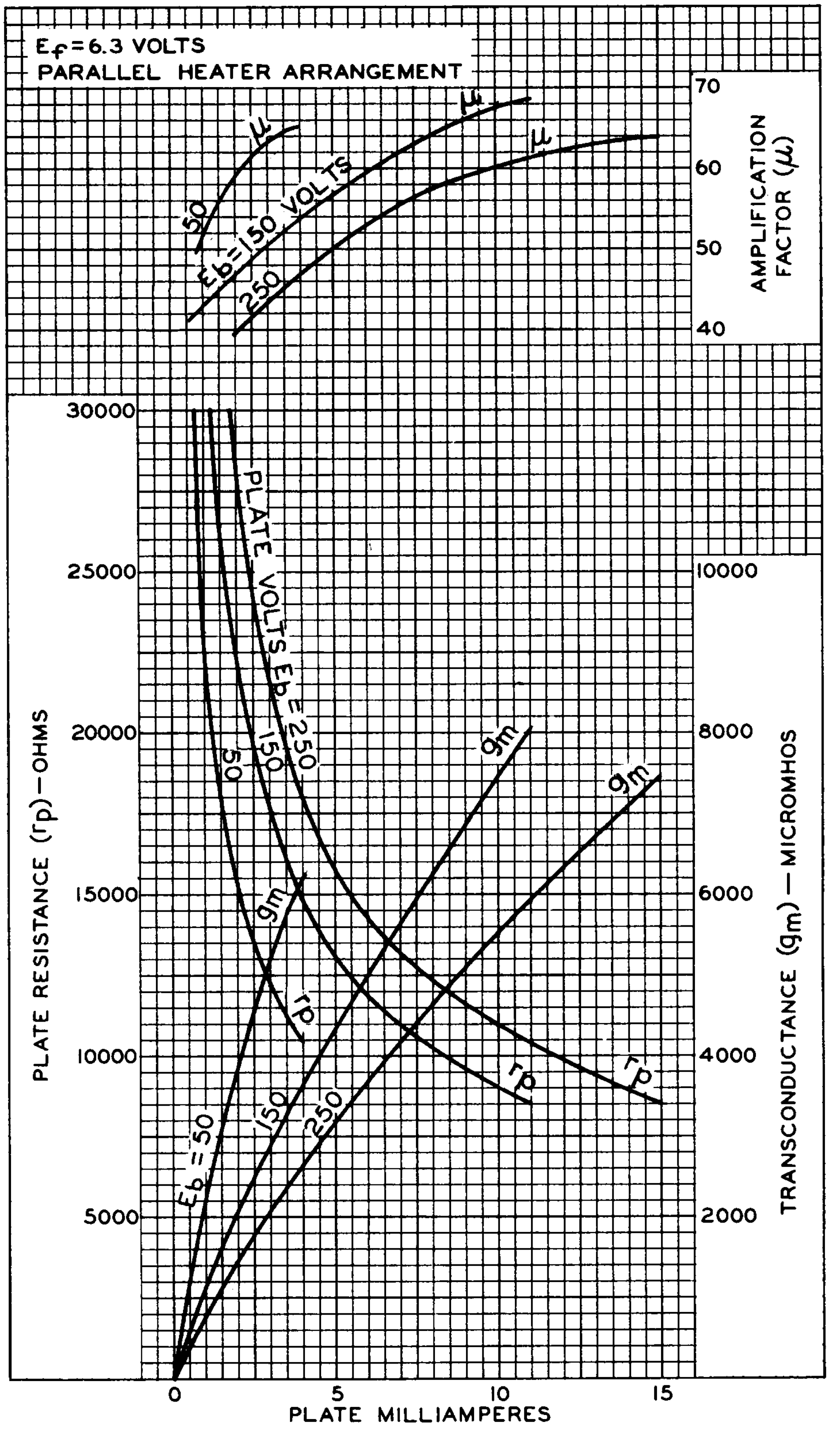


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AVERAGE CHARACTERISTICS
EACH UNIT



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